

**A. BELYAYEV**



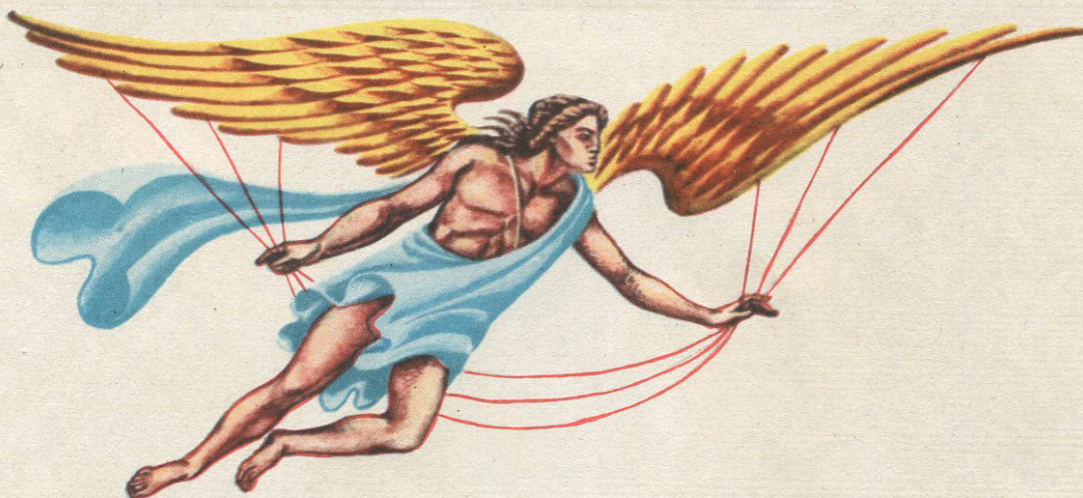
# **HOW MAN LEARNED TO FLY**

**M A L Y S H   P U B L I S H E R S**









**T**here is, probably, hardly a day when you, dear reader, do not see an airplane in the sky. Perhaps you have already flown yourself? Arrived at an airport. Climbed on board a handsome air-liner. Sat down in an upholstered seat, fastened your safetybelt and turned to look through the window—the porthole. The engines began to hum and the plane rolled along the cement runway.

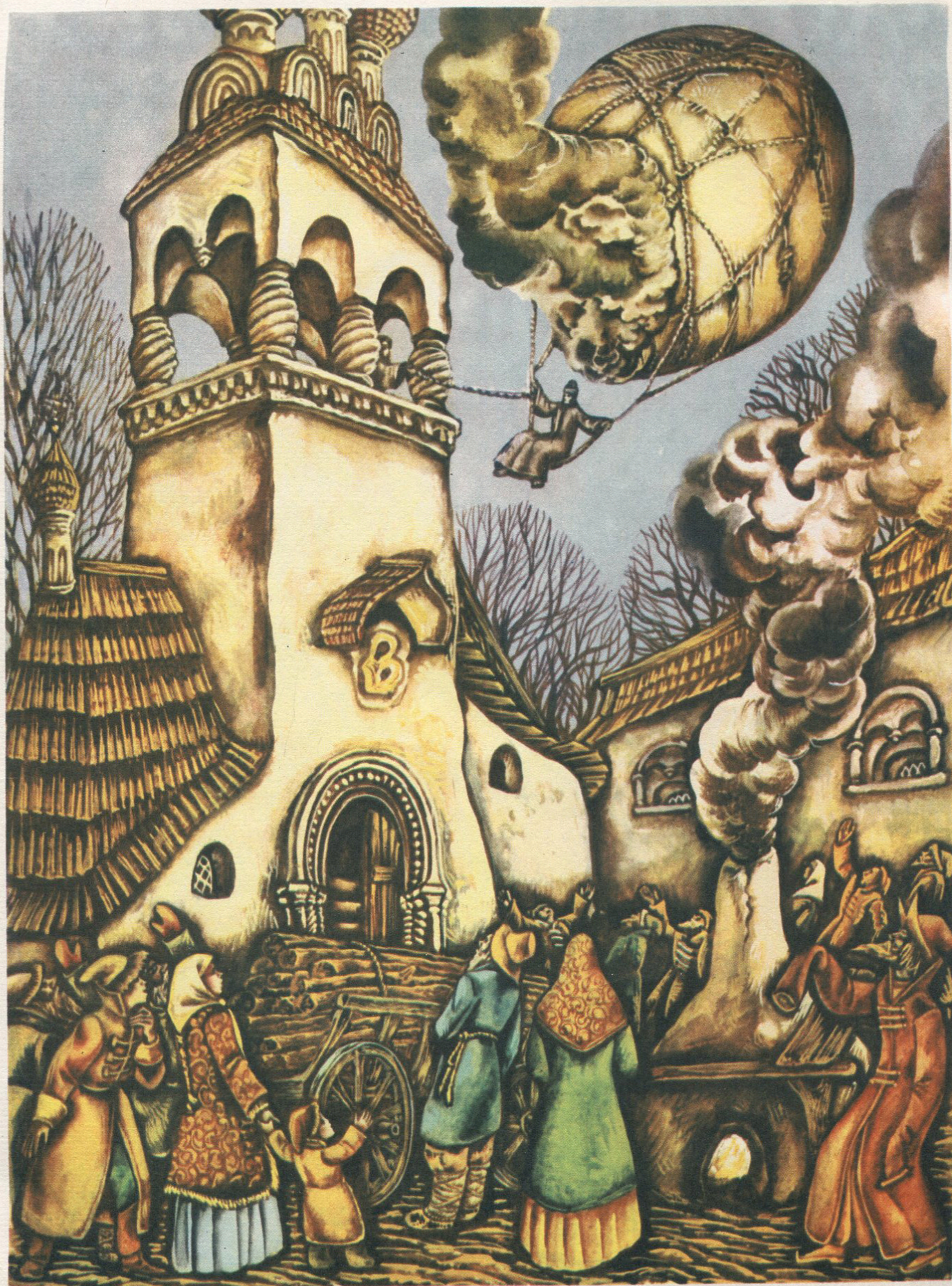
Soon it took off and flew up, higher and higher, and then rose above the clouds. How wonderful it is to fly! But do you know that airplanes came into being rather recently, no more that seventy years ago?

Since time immemorial people dreamed of tearing away from the earth and flying like birds. Legends were created about flying people. There is an ancient Greek legend about an inventor and architect Daedalus and his son Icarus. Using wax and feathers, they made wings and rose up into the air to escape from the island of Crete where they were held in captivity. To tear away from the long familiar earth and soar high in the air like birds! It felt so marvellous that Icarus forgot about his father's warning not to get too near the sun. He flew up so high that the rays of the sun melted the wax, and Icarus fell straight into the sea. But Daedalus safely reached Sicily and later returned to Athens.

Or let us recall the Russian fairy-tales: the witch Baba-Yaga flies on a broom, Ivanushka—on the Little Hunchbacked Horse, Tsarevich Ivan—on a magic flying carpet.

But fairy-tales remained fairy-tales, whereas people wanted to fly in real earnest.







## FLIGHTS ON LIGHTER THAN AIR CRAFTS

### *Who Was the First to Take to the Air*

Nobody knows exactly where and when the first attempt to fly like a bird was made.

Most likely such attempts were made in different countries at the same time. There is no reliable information on the subject. However, everywhere people dreamed of flying and attempted to do it.

It is known that in Russia man rose into the air about three hundred years ago.

That happened in the town of Ryazan. A clerk, named Kryakutnoy, watching the smoke of a bonfire rising up, asked himself: "Cannot one somehow catch on to the smoke and go up along with it?" He made a balloon with a loop attached to it, filled the balloon with the hot smoke, settled himself into the loop and flew up... higher than the birch trees.

But people were very backward at that time. All who saw him fly decided that he did it with the help of evil spirits. They even wanted "to bury him alive or else burn him"—that is how the chronicles recorded it. But then they took pity on him and merely chased him away from their town.





The balloon of the Montgolfier brothers



Charles' aerostat

## Who Built the First Balloon?

People had long noticed that not only smoke but hot air also rose up. Among the first to decide to use hot air for flying were two Frenchmen, the Montgolfier brothers. They made a balloon out of paper and linen, filled it with hot air and the balloon flew up. It rose to a height of about 500 meters. This took place in 1783.

The Montgolfier brothers sent their balloons up with animals on board and even went up themselves.

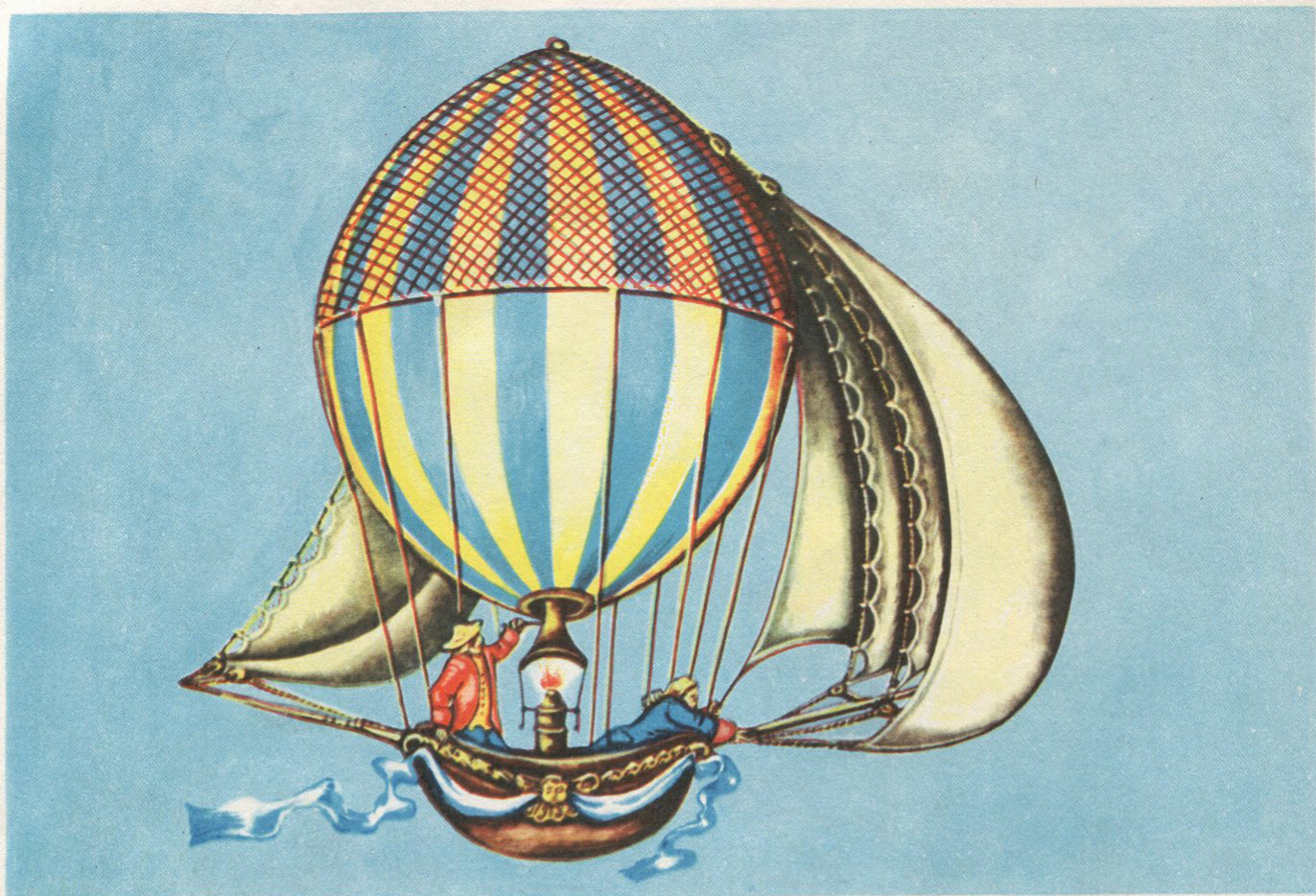
The French scientist Charles made another experiment. He filled a balloon with hydrogen, a gas which is lighter than air. In 10 minutes his balloon rose to an altitude of 1,000 meters. The flight of that airship lasted over two hours.

Ever since then free flying balloons began to rise up into the sky more and more often.









### *Controlled Aerostats*

Balloons opened the way to the skies; they rose up because they were lighter than air. But you could not get far on a balloon like that because it was an obedient plaything of the winds—it flew wherever the wind blew. And people wanted to fly in the direction of their own choice. How was one to control the flight of a balloon?

In the fifties of the last century the Russian inventor Arkhangelsky designed a balloon which looked like a boat, with a sail and wings; the wings folded up on the ascent and spread out on the descent. The whole mechanism was put in motion by a steam engine.

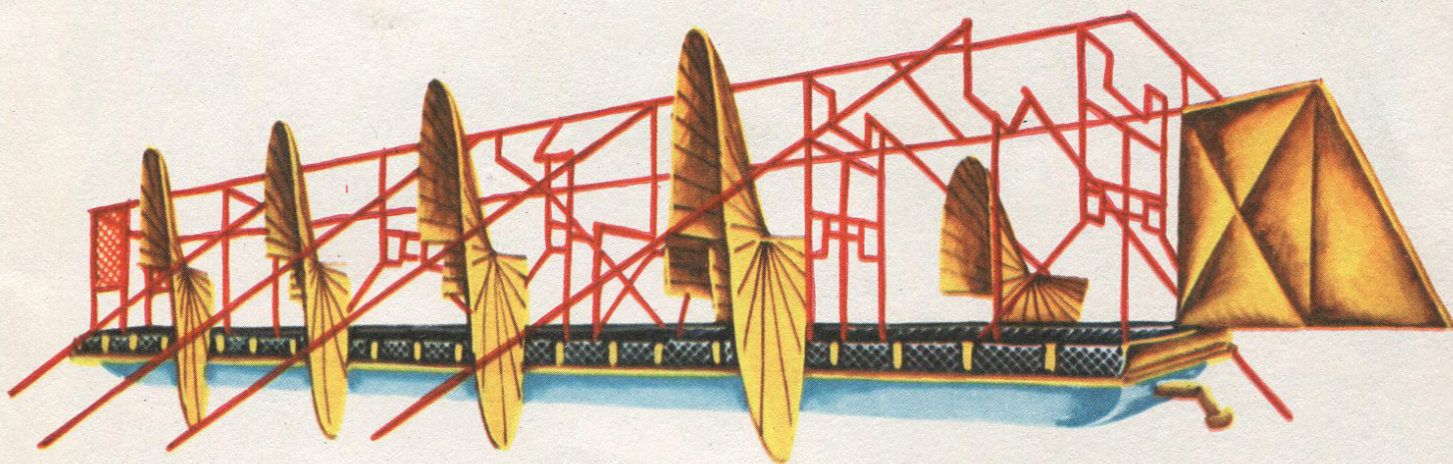
Fifteen years later the inventor Sokovnin suggested



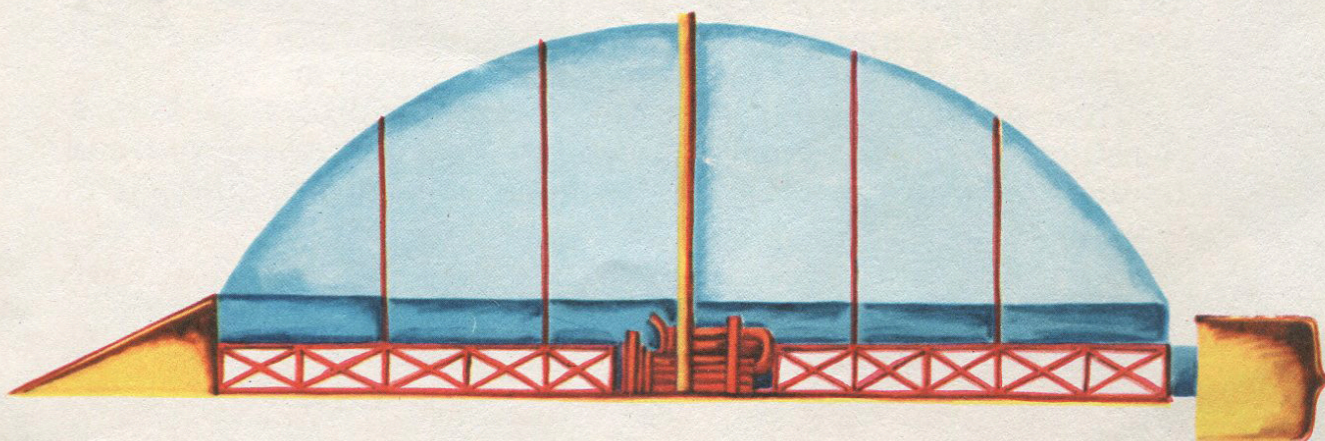
making the envelope of the aerostat, not of a soft fabric but of something rigid, some special kind of cardboard. The aerostat was provided with two rudders—one for ascending, the other, for turning to right or left.

In 1875 the Russian scientist Dmitri Mendeleyev worked out a design for a controllable aerostat which could rise as high as 11 kilometers and even higher. To safeguard man from perishing at such a height, Mendeleyev provided a special cabin which would not let the air out—hermetically sealed cabin.

Aerostats which could rise up to 11 kilometers and higher came to be called stratospheric balloons.



The design of the aerostat made by Arkhangelsky, 1851  
A boat-like craft powered by a steam engine



The controllable aerostat designed by N. Sokovnin, 1866



## *Dirigibles*

A dirigible is a controlled aerostat, that is, an aerostat provided with an engine to which a thrust airscrew (propeller) is attached.

The engine gives speed to the flight and makes it possible to control its direction. In a tailwind the dirigible can fly with the engine switched off.

The dirigibles were continually perfected. They were given the form of a cigar, which helped to increase their speed. Partitions were built inside the balloon, so that in case of damage to the envelope, the escape of the gas would be limited to only one compartment and the whole of the container would not collapse.

Dirigibles served people well. However it was dangerous to fly them. In those days the envelope of the dirigible was made of a soft material which was easily inflammable. The inside was filled with hydrogen, a gas which would ignite at the smallest spark. Such a great number of dirigibles met with accidents that people stopped producing them.

However, in our time, when the envelope of a dirigible can be made of light aluminium alloys and filled with an unflammable gas, helium, they no longer hold any danger. And they are again beginning to be built in a number of countries.

Dirigibles can now be provided with very powerful engines. Such dirigibles would be able to lift up to 500 tons and more of cargo.

Straight from a plant a dirigible could lift a huge heavy machine, or enormous pipes for some pipe-line, or bulky and heavy building materials and carry them through the air for hundreds of kilometers to the desired destination.

This great lifting capacity of the dirigibles makes it possible to build them as passenger air-liners with spacious salons, swimming pools, play-grounds and cinema halls.

1. A world record for duration of flight was made on this dirigible in 1936
2. Dirigible of Renard and Krebs, 1884
3. Dirigible of Giffard, 1851
4. Dirigible The Swan, 1907
5. Zeppelin Dirigible, 1906
6. Dirigible of Malykhin, 1886







## FLIGHT ON WINGED CRAFT

### *How Man Learned to Glide*

While some inventors were busy perfecting the airballoons, others tried to build machines which would rise in the sky freely like a bird.

In Russia, some three hundred years ago one man asked the tsar to give him eighteen roubles to make wings like those of a crane and by flapping them rise up into the air. He was given the money and he did make the wings but did not fly up. He explained his failure by the fact that "those wings were made too heavy". He did not realise that man's muscles are not a sufficiently powerful engine. This fact had been proven long before his time by the great Italian artist and scientist Leonardo da Vinci who had made a thorough study of man's anatomy.

Watching the birds, people noticed that they can fly or soar in the air on widely spread motionless wings—that is, they can glide. And man tried to immitate the birds.

The shop assistant Ostrovkov from the village of Pekhletse near Ryazan constructed wings out of a bull's bladder, giving them the form of a steep-pitched roof. And the chronicles have it: "a strong wind carried him up, over people's heads and threw him against the top of a tree". Ostrovkov's wings were held up by a natural air current. His flight was of a soaring kind.

Providing themselves with wings men would jump down from high places and some of them succeeded in gliding through



the air. This kind of soaring or gliding flight led to the creation of the glider—a flying machine with wings but without any propulsive engine.

It is a known fact that Leonardo da Vinci made sketches and built a model of a glider, which was probably the first in the world.

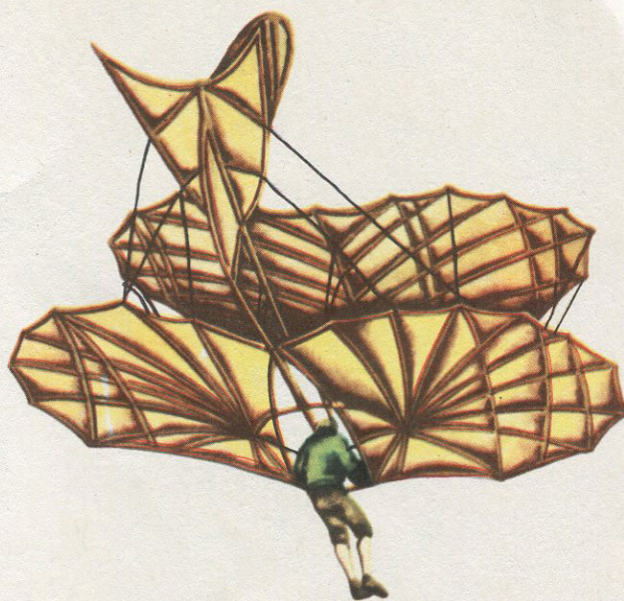
The very first gliders were very simple, almost like kites. You must have seen kites being flown or maybe even have flown them yourself—you run holding the end of a string in your hand and the kite, attached to the string's other end, rises higher and higher.

There were all sorts of gliders built: with one wing, with two wings and even with three, the so called triplanes.

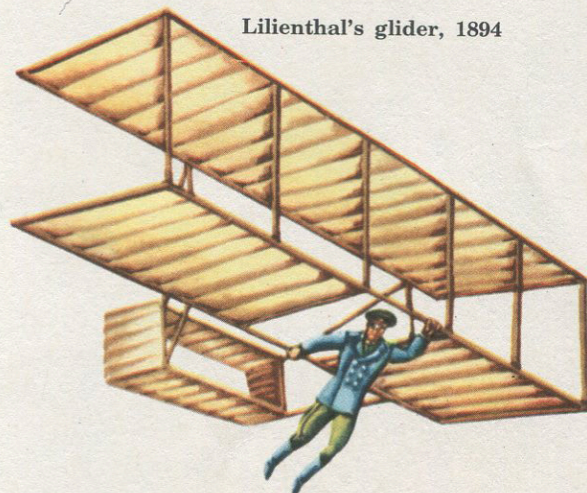
In our country the first glider was constructed in 1874.

But glider flying began to develop particularly widely about seventy years ago.

In 1910 the famous Russian pilot Pyotr Nesterov boldly flew a glider in the town of Nizhny Novgorod. However, gliders could not fly any faster than the natural air currents which held them up in the air. In the meantime people wanted to fly faster than the wind, they wanted to fly high and far—for many thousand kilometers.



Lilienthal's glider, 1894



Nesterov's glider, 1911



A sports glider, 1948





Mozhaitsky's airplane, 1883



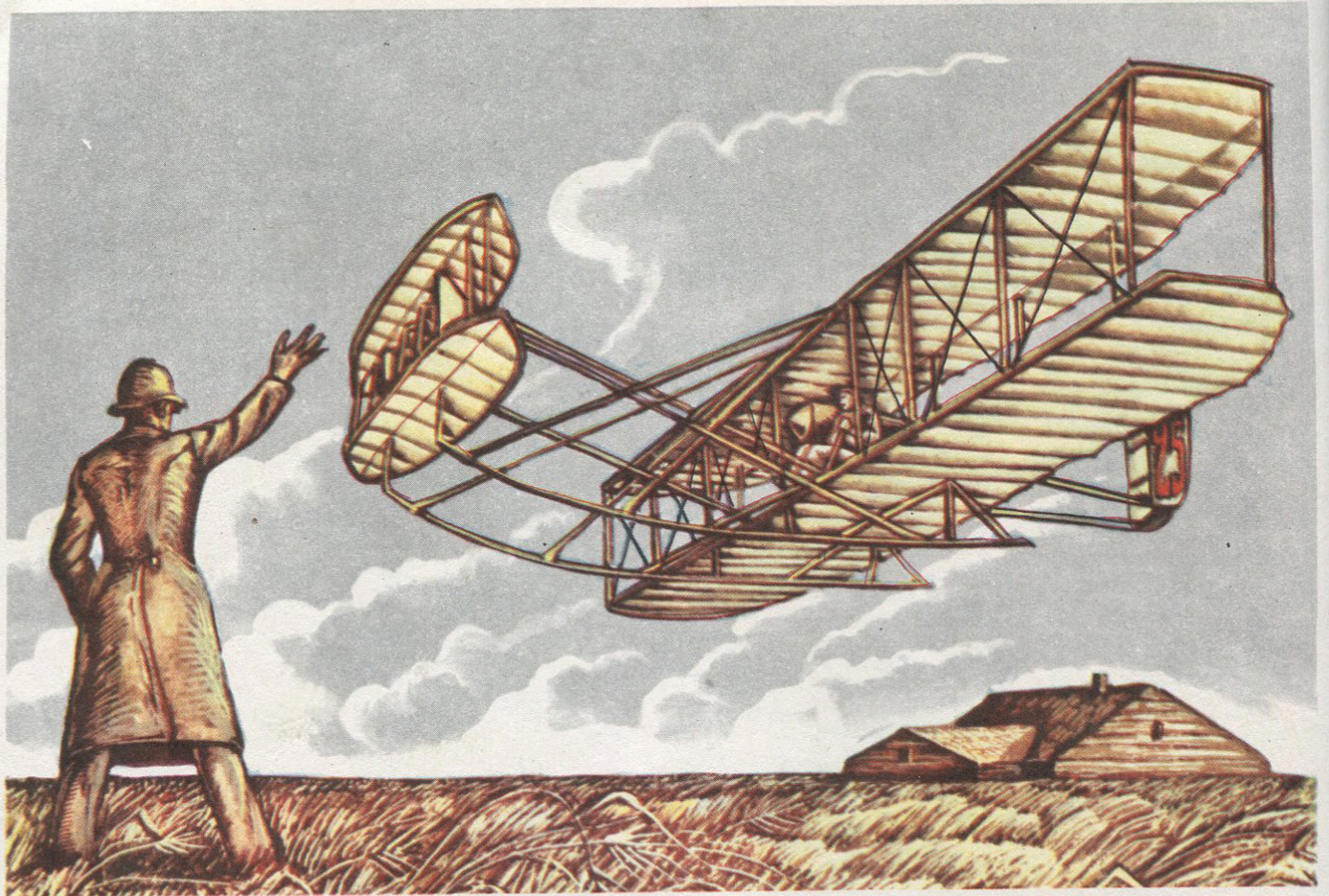






Mozhaisky's airplane, 1883





Wright airplane, 1903

### *From Gliders to Planes*

It is now over a hundred years ago that the Russian inventor Alexander Mozhaisky thought of constructing a controlled "flying machine" heavier than air.

For a number of years he studied the flight of birds and constructed and tested various models of flying crafts.

And at last the long awaited moment came.

Mozhaisky installed an engine on his craft with the help of which the craft "could not only fly but run over the ground



and float in water,” as the Russian naval newspaper *Kronshtadt Vestnik* wrote in 1877.

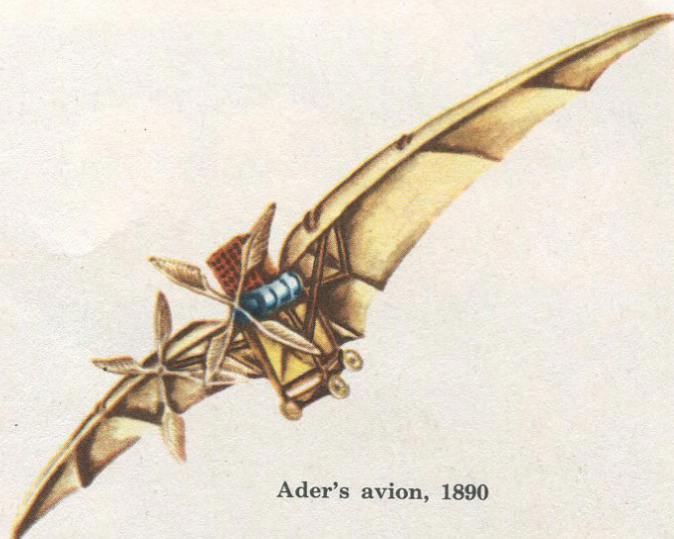
Mozhaisky's machine had all the five essential parts of the modern plane: wings, fuselage, engine (steam) with a propeller, tail fin to ensure the stability of the craft, and chassis—the landing gear with wheels attached—on which the fuselage of the airplane rests.

The craft designed by Alexander Mozhaisky is considered to be the first airplane in the world constructed in full size and able to fly with a man on board.

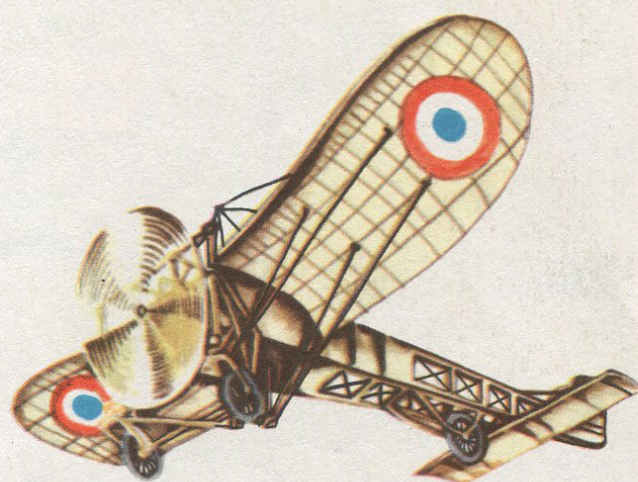
Only 20 years later were similar airplanes constructed by other people: the Frenchman Ader, the Englishman Maxim, and the Americans—Wright brothers.

The Wright brothers installed on their airplane an engine which used petrol for fuel. That engine was similar to an automobile one.

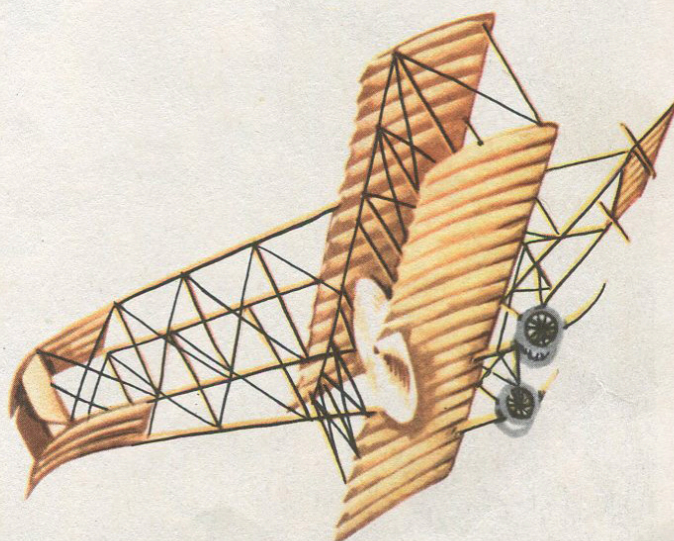
It was much lighter than a steam engine which was heavy and required a heavy fuel. The Wright brothers made a number of more or less long-range flights and convinced people that the future of aviation belonged to airplanes.



Ader's avion, 1890



Bleriot's monoplane, 1909



Russia A biplane, 1910







## *Higher, Faster, Farther*

Thus people came to realize that airplanes could fly to any place and at any moment—winter and summer, day and night, in tailwinds and headwinds. And above all, their speed was much greater than that of any other flying craft.

As a result, the building of airplanes began to develop in many countries.

Russian inventors and designers from the very start built multi-engined powerful airplanes according to the standards of those days. The first of them was called *The Russian Knight*. It rose into the air on May 13, 1913. It was a biplane with four engines. It weighed 3,500 kilograms. And its lifting capacity was almost 1,500 kilograms. It needed only a 700 metre-long runway to be airborne. And its flying speed was 90 kilometers an hour.

Later an improved model was built—*The Iliya Muromets*. In those days it flew higher and farther than any other. Several such airplanes were attached to the Red Army forces during the Civil War. They bombed the White Guard cavalry, made reconnaissance flights, helped the Red armymen defend the young Soviet Republic.

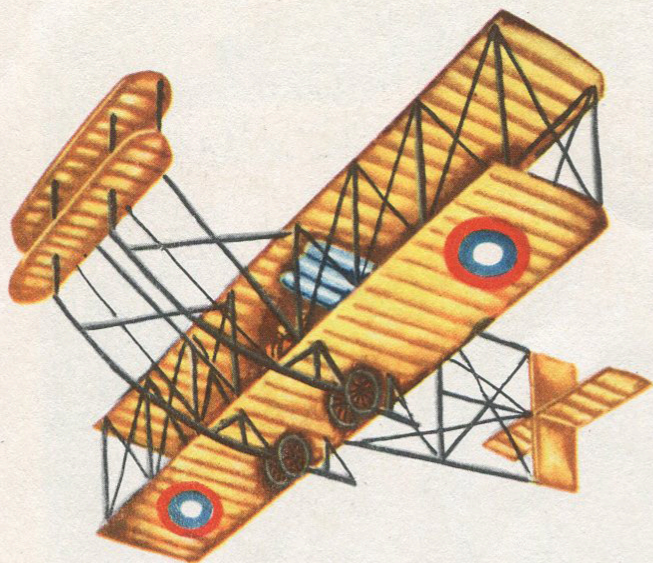
After the October Revolution aviation began to develop rapidly in our country. Test flights were made of a giant airplane *The Svyatogor*. The building of that powerful craft had been started in 1913, but was delayed because of the First World War.

A number of fine airplanes were built in those days.

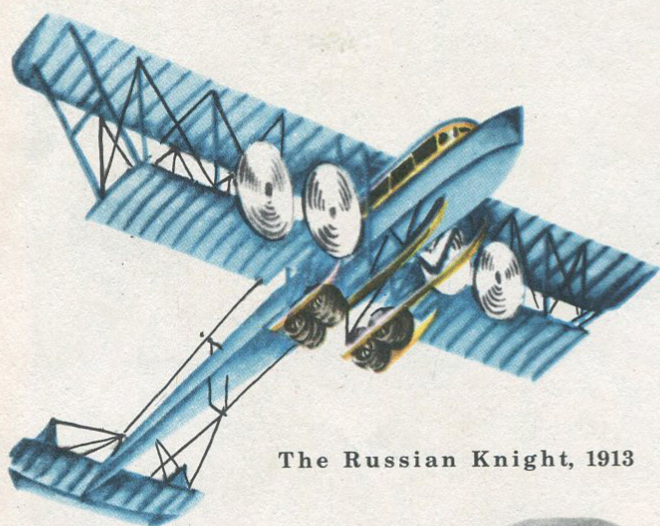
In 1934 in our country there rose into the air the giant ANT-20, named after the great proletarian writer Maxim Gorky.

It was the most powerful flying craft in the world. Its wing span reached sixty-five meters, the length of its fuselage—thirty-two and a half meters. The airplane was provided with eight motors and could carry 80 passengers. It could fly by day and by night, in any weather.

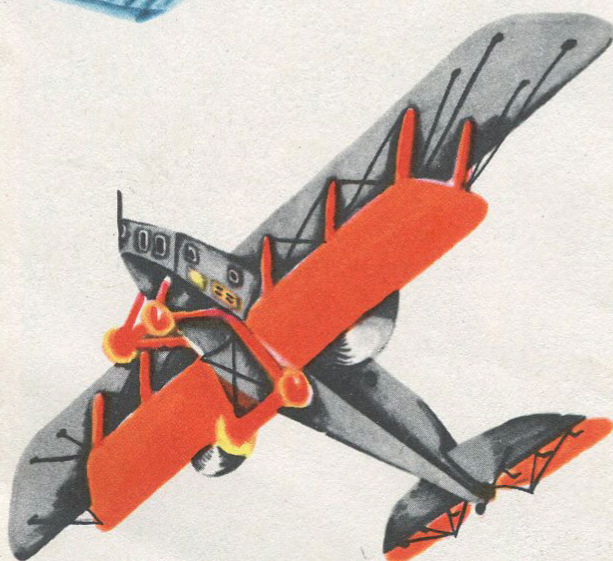




Grizodubov's airplane, 1910



The Russian Knight, 1913



Svyatogor, 1916

In the years before the Second World War our Soviet aviators flying on airplanes made by Soviet designers established dozens of world records for distance, altitude and speed.

All sorts of airplanes were constructed. They began to be used for sowing, for crop dusting, for putting out forest and steppe fires, for transporting big and cumbersome cargoes.

Then the helicopter appeared, a marvellous flying craft. Where an ordinary airplane has no chance of taking off or landing, a helicopter saves the situation. An airplane needs a runway but a helicopter rises into the air without it. It takes off vertically, from a forest glade, from an ice-floe, or from the deck of a ship.

With every year airplanes flew ever higher, faster and farther. And finally, the moment arrived when an airplane appeared which flew at a speed of more than a thousand kilometers an hour. That was the jet plane.

- Airplanes:  
 1. ANT-20  
 2. MIG-21  
 3. IL-76  
 4. LA-5  
 5. PE-2  
 6. YAK-40  
 7. TU-144







On May 15, 1942, the Soviet Army pilot Grigori Bakhchivanadze made the first jet plane flight.

Today men are already learning to fly airplanes at speeds of two and a half and three and a half thousand kilometers an hour. Compare these modern planes with those of twenty or thirty years ago. Their speed is different, and their shape, too, is noticeably different from that of their predecessors.

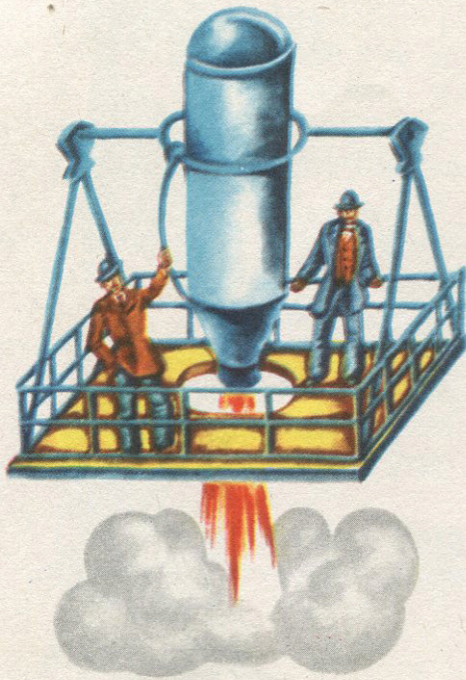
Tomorrow, and the day after tomorrow, and a hundred and two hundred years from now man will persistently continue to storm the skies. He will learn to fly still faster and higher. As a matter of fact, the storming of the skies has just only began.

Helicopters:  
1. KA-15M  
2. V-12

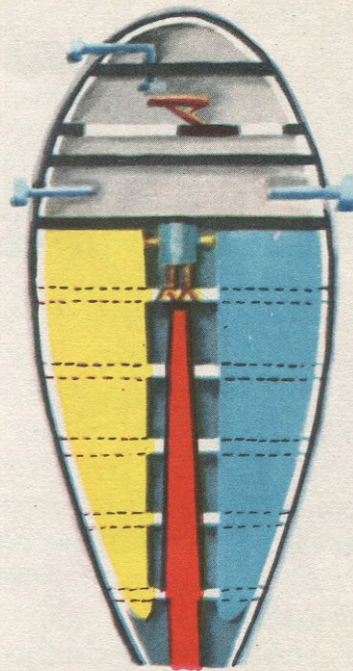




## SPACESHIPS



Design of a rocket by Kibalchich



Design of a rocket by Tsiolkovsky

### *Scientific Exploit*

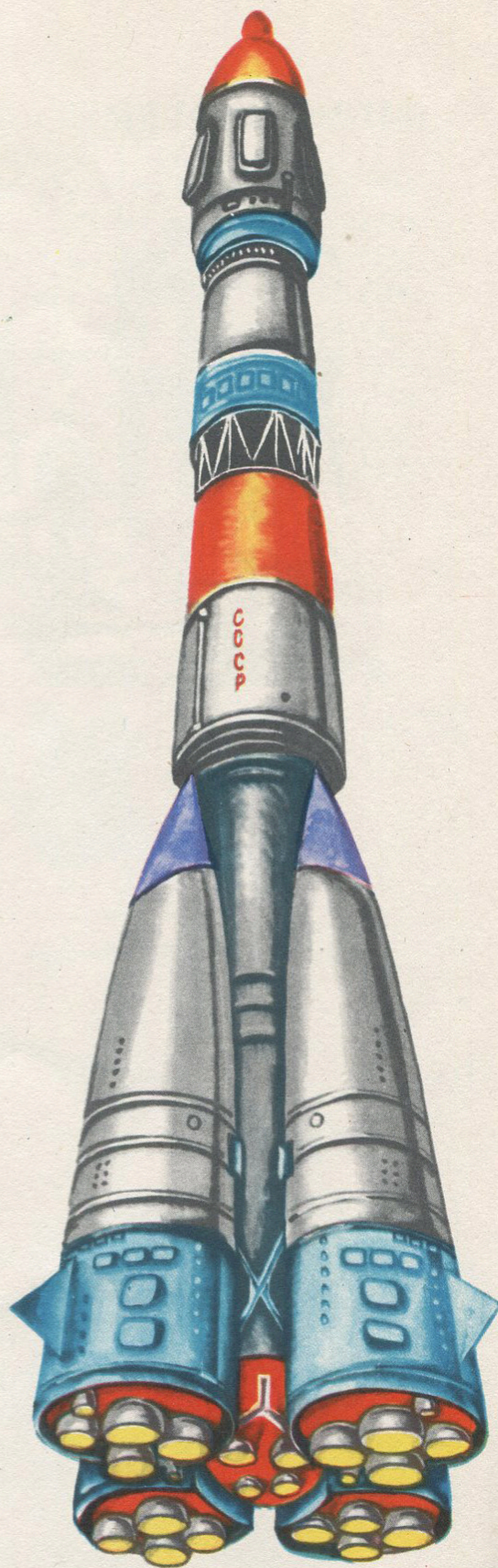
You have already learned that man has risen into the air on lighter-than-air and on winged heavier-than-air machines. But man has continued his researches and has succeeded in creating a craft, that is heavier than air and possesses no wings, and yet is able to fly as far as the Moon.



Yes, you have guessed right. We are speaking about space-ships.

Let us go back to the end of the last century, to March, 1881. A young Russian inventor, Nikolai Kibalchich, was sitting in a solitary cell of a prison and writing. He was to be executed the next day as a revolutionary. He had made a bomb and thrown it at the carriage in which the much-hated tsar rode. The imperial court condemned Kibalchich to death. And so he sat in his cell hurrying to finish his great project, for the next day the execution would be carried out. What was his project? Nikolai Kibalchich, for the first time in the world, designed a jet-propelled flying machine. The design consisted of a platform with metal struts to which a powder rocket engine is attached. When the powder inside the combustion chamber blew up, a powerful jet of burning gases would spurt out of the nozzle of the rocket, thus thrusting the machine up into the air.

Unfortunately, Kibalchich's invention became known only after the Great October Revolution. Till then it lay buried in the archives of the tsarist police.





## *A Great Scientist*

At approximately the same time, in the small town of Kaluga, a teacher of physics, Konstantin Tsiolkovsky, also began to explore the idea of rocket flight. He dreamed of man's flight to distant planets and, like Kibalchich, saw rockets as the future of spaceships. He suggested using liquid fuel in the rocket instead of powder. And he worked out and drew the design of such an engine. And to think that he did this at the time when people were just learning to construct the first airplanes!

Nobody took his projects seriously, but Tsiolkovsky continued working.

At the very beginning of the twentieth century he designed an artificial island floating in space. This island, assembled out of a number of rockets, was to become a small artificial moon.

Tsiolkovsky lived a long life and made many discoveries. He became a scientist of world renown.

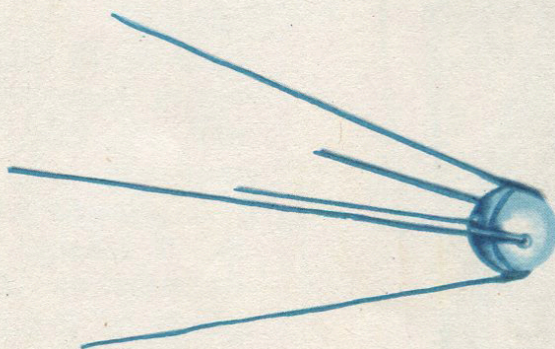
## *Space Flights*

The dreams of the great scientists have come true. Hundreds of Soviet-made artificial satellites—sputniks—orbit the earth. They effectively serve the people by forecasting the weather, locating mineral deposits, watching out for forest fires. They also ensure radio and television communication between far removed points on our planet. Our country was the first in the world to launch a spaceship with a man on board. The name of that man was Yuri Gagarin—the world's first cosmonaut.

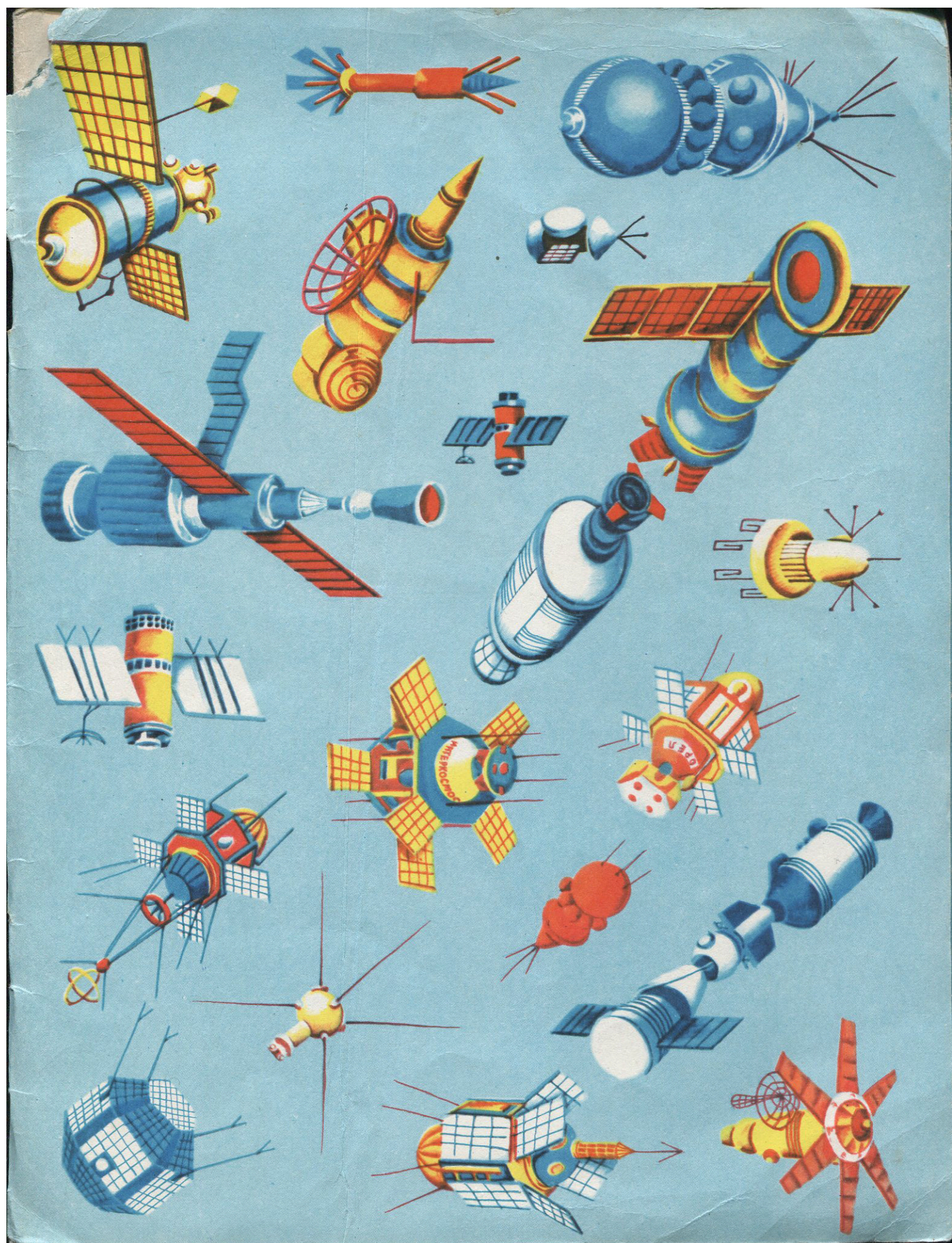


It took the chief designer of our spaceships Sergei Korolev a great many years to create such a rocket-propelled spaceship. He lived through moments of joy and moments of bitter disappointment. The rockets would blow up before taking off, they would plunge down, refuse to fly. But the day came when all troubles were left behind. And now man with the help of powerful multi-stage rockets is storming outer space. Spaceships have reached Moon, Venus, Mars. Every new sputnik, every new spaceship is larger and better than the one before. Look at the sputniks and spaceships the artist has drawn in this book and you will see that this is so.

It may so happen that you, my dear young friend, will become a pilot or a spaceman, or will design or construct airplanes and spaceships. I wish you the greatest success. And every time you fly an airplane or a spaceship, or watch them fly remember that our country is the motherland of aviation and space flight.









Alexander Belyayev  
HOW MAN LEARNED TO FLY

Illustrated by *M. Romadin*  
Translated by Valentina Jaque

Malysh Publishers

Moscow  
Printed in the USSR

© Издательство «Малыш», 1977

Rs 2 P 25